RECONNAISSANCE AREA

Approximately 4,000 mi.^{2} (67%) of the 6,000 mi.^{2} Big Cypress Bayou Watershed was traversed for this ecological reconnaissance. Tbe reconnaissance area extended from Black Bayou drainage east of Oil City and Mooringsport, LA and southwest Miller County, AR, west approximately 125 mi. to the Watershed's origin in Hopkins, Wood, and Franklin Counties, Texas (Figure 1)

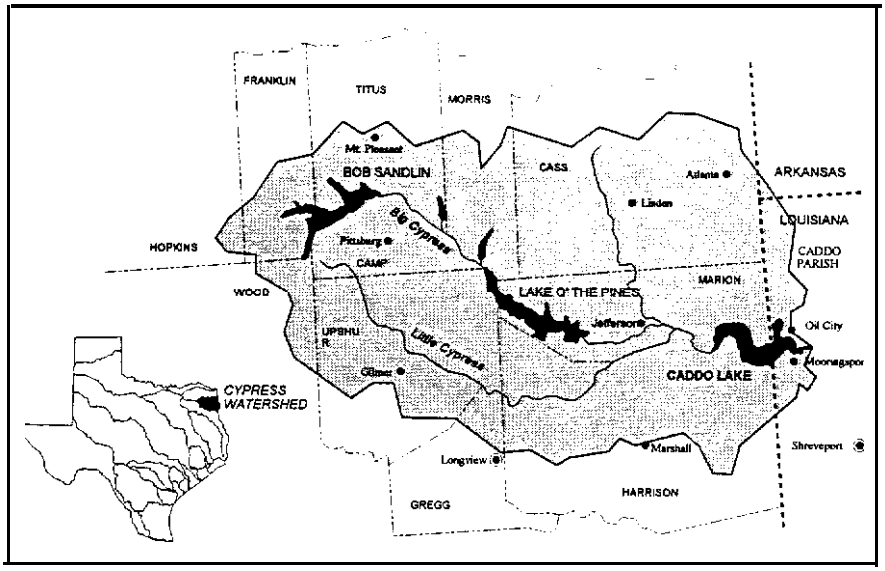

Figure 1. Location of Big Cypress Bayou Watershed

Climate and soils of this area are thoroughly described by the U.S. Natural Resources Conservation Service (USNRCS), formerly the U.S. Soil Conservation Service (1972, 1977, 1980, 1981, 1983, 1990), Godfrey et al. (1973), and Campo (1986). Consequently the climate and soils are not elaborated herein. Environmental conditions particularly noted that influence the distribution of vegetation cover types, native animals, and land uses are mentioned below.

The climate becomes substantially drier and the mean elevation higher east to west in the region. Yearly rainfall averages 48 in. and the relative humidity 85% in the eastern Watershed, and declines to

44 in. and 55% in the western Watershed (USNRCS, 1977, 1980, 1983, 1990; Jordan et al., 1984; Campo, 1986). Elevation ranges from 140 ft. mean sea level (msl) up to 650 ft. msl, east to west.

Major soil orders are Alfisols and Ultrasols. Ultrasols occur mainly on the east half of the Watershed. They are severely leached, acid, sandy to sandy-loam soils that evolved under pineywoods (Pineywoods ecological region). Alfisols are characteristic of the Blackland Prairies and Post Oak Woods and Parks ecological regions that occur primarily on the west half of the Watershed (LBJ School of Public Affairs, 1978; Doughty, 1983; Jordan, et al., 1984). Blackland Prairies to the west and Pineywoods to the east are divided by Post Oak Woods and Parks

A labyrinth of streams transect Big Cypress Bayou Watershed and flow generally west to east. Six stream systems provide the principal drainage. Big Cypress Bayou is the dominant drainage. It is bracketed by James Bayou (also called Jim's or Jeem's Bayou) and Black Cypress Bayou on the north and Little Cypress Bayou on the south. These streams converge east of Jefferson, TX. From there, a single Cypress Bayou channel continues east through Caddo Lake and on to its confluence with Red River at Shreveport, LA. Frazier Creek enters Caddo Lake from the north, near the Texas-Louisiana boundary. Black Bayou drains the northeasternmost Watershed from above Atlanta, TX and extends southeast into Caddo Parish, LA.

Cypress Springs Reservoir, "Lake" Bob Sandlin, and "Lake" 0' The Pines, all located on Big Cypress Bayou, are the major reservoirs. Secondary reservoirs include Welch, Ellison Creek, Johnson Creek, and Lake Winnsboro. Lake 0' The Pines is centrally located in the Watershed. The other reservoirs are in the west half. Lake 0' The Pines in particular has a substantial influence on the ecological integrity of Big Cypress Bayou (see **FINDINGS AND DISCUSSION).**

Caddo Lake is the largest lacustrine (lake) waterbody in the Watershed (about 25,000 ac). Caddo is considered by many to be the only major natural lake in Texas (Campo, 1986; Cloud and Watson, 1991;

Chapman and TPWD, 1993; U.S. Bureau of Reclamation, 1994). Caddo Lake, together with its contiguous cover types, is the Watershed's premier ecological complex. Much has been written about the cultural, recreational, economic, and ecologic importance of this lake (Dahmer, 1988; U.S. Army Corps of Engineers, 1994). Caddo has the highest federal wetland resource value ranking. It is one of 13 areas in the United States on the RAMSAR International Convention Treaty's list of wetlands of international importance (Cloud and Watson, 1991; Chapman and TPWD, 1993). While attention has been given to the protection of Caddo Lake per se, less attention has been given to protection of the streams that influence its natural integrity. There are recent signs of increase in waste dumping; eutrophication; and agricultural, municipal and industrial pollution of the streams and, consequently, of the reservoirs and Caddo Lake (see **FINDINGS AND DISCUSSION).**

Small lakes, ponds, and marshes (many man-made) are scattered throughout the Watershed. Some were created by beaver damming activity Per unit of area, beaver-created wetlands are among the most ecologically productive habitats in the Watershed.

Traditionally, land and waters throughout the Cypress Bayou Watershed are used primarily for livestock, crops, hay and timber production, hunting, and fishing. Various kinds of outdoor recreation are important economic enterprises. Principal livestock enterprises are beef cattle and poultry production, and dairy farming (USNRCS, 1972, 1977, 1980, 1990; Campo, 1986). Livestock largely are confined to pastures, but rangeland grazing is practiced as well. Particularly in the west, rangelands contribute substantially to the forage needs of livestock and white-tailed deer (USNRCS, 1977). However, these undeveloped lands are giving way to hay production, surface mining, and urban and suburban development.

OBJECTIVES

The general objective of this reconnaissance was to provide information to aid in the assessment of current ecological conditions as they relate to comprehensive Watershed-wide management planning. Specific tasks, in order of importance, were to:

- Provide ground information to facilitate satellite imagery mapping,
- Identify the major vegetation cover types within the Watershed.
- Describe the cover types as to their physical features, characteristic plant and animal species, and relative ecological roles.
- Report plants and animals and plant communities encountered that are listed by the Texas Parks and Wildlife Department as requiring special attention (protection consideration).
- Identify environmental disturbances that threaten the Watershed's ecological integrity.
- Present considerations for protection of the Watershed's ecological integrity, commensurate with sustainable economic development.
- Write a report meaningful to the general citizenry,

PROCEDURES

Conditions that dictated the reconnaissance procedures used for this project were availability of personnel, time allotted for the work, accessibility to field observation points, and size and complexity of the Watershed.

Literature Review

Cover Classification

Classification schemes were reviewed for their applicability to the region and suitability for this reconnaissance. Information reviewed included Kuchler (1964), UNESCO (1973), Anderson et al. (1976), University of Texas at Austin (1977, 1978), LBJ School of Public Affairs (1978), Telfair (1978), Bailey (1978), Cowardin et al. (1979), TPWD (1980), Eyre (1980), McMahan et al. (1984), Wenger (1984), Campo (1986), Diamond et al. (1987), Brabander and Barclay (1994), McKinney (1994), VanKley (1994; in prep.), and U.S. Forest Service (USFS, no date).

Maps and Aerial Photographs

Satellite imagery maps produced by TPWD, USCOE, and the National Biological Service (NBS) were reviewed. U.S. Geological Survey quadrangle maps and infra-red aerial photographs (1:24,000 scale) were studied. Hard copies of satellite imagery have been produced by TPWD, NBS, and USCOE. During this study, the only imagery map found that covered the entire Watershed was done by McMahan et al. (1984). Existing imagery maps by NBS and USCOE only cover the region near Caddo Lake. Hard copy maps and aerial photographs reviewed lacked sufficient resolution to be useful for the needs of this reconnaissance. Quadrangle maps that cover the Watershed were prepared 20-40 years ago and had limited utility. Work is underway by TPWD, USCOE, and NBS to produce current cover maps of the entire Watershed.

Physical and Biological Information

Climate, topography, and soils information applicable to Big Cypress Bayou Watershed was reviewed in USNRCS (1972, 1977, 1980, and 1990), Godfrey et al.(1973), Doughty (1983), Jordan et al. (1984), Campo (1986), Cloud and Watson (1991), and USFWS (1985; 1992). Information on plants indigenous to the area was reviewed in Cobb (1963), Kuchler (1964), Shuttleworth (1967), Hotchkiss (1972), Gould (1975a,b), Correll and Johnston (1979), MacRoberts (1979), Godfrey and Wooton (1981), Ajilvsji (1984), Nixon (1985), Campo (1986), Reed (1988), Hatch, et al. (1990), Cloud and Watson (1991), Hine and Nixon (1992), Powell (1992), Hine and VanKley (1994), USACOE (1994), and Telfair (pers. comm., unpub. list).

References consulted for native animals in the following categories were:

invertebrates - Klots (195 1), Borror and White (1970), Pennak (1989);

mussels - Shafer et al. (1992), Howells (1994), and Mather and Bergmann (1994);

invertebrates and fish - Bayer et al.(1992), Howells (1992);

fish - Kemp (1954 a,b), Bonn (1956), Hardy and Legrande (1979), and TPWD (1985);

amphibians and reptiles - Conant (1975) and Hardy (1979);

birds - National Geographic Society (1983), Hardy (1992), Northeast Texas Field Ornithologist (1994), and Rappole and Blacklock (1994); and

mammals -Hardy (1982), Nowak (1991), and Davis and Scbmidley (1994).

Plants and animals of special concern were found in TPWD (1989) and USDI (1992).

Statistical techniques used for this reconnaissance were derived from a review of Grub (1958), Krebs (1978), Schemnitz (1980), Dowdy and Wearden (1983), Cooperrider et al. (1986), and RC. Rowan (pers. comm.).

Ecological Reconnaissance

Field work began in early June, 1994 and was terminated in late October to meet the project completion date. Early on, efforts were made to find a current cover map of the Watershed produced from satellite imagery. In addition, the applicability of the Gap Analysis System for Texas was tested (McKinney, 1994). The Gap Analysis System is so named since it discloses not only where species richness is highest but also where significant gaps exist in the protection of this richness. Initial activity, therefore, involved an east-west traverse across the Watershed to locate, identify, and describe major cover types and test GAP in the field. Findings were forwarded to the USCOE, Fort Worth, Texas and the TPWD Resource Protection Division. Subsequently, random traverses were conducted to accomplish Watershed-wide distribution of point observations on major cover types (Appendix B). Vegetation conditions, the native plant and animal species that characterize each cover type, unique and special attention species, natural plant communities of special concern, wildlife habitat value estimates, and ecological quality estimates were recorded. Observations included sites on headwater reaches of major Watershed streams (Appendix B). Streams were accessed from road crossings. Stream beds were traversed for distances up to 1000 ft. to observe the aquatic species present and to visually assess stream conditions. Seine samples were taken using 1/4 in. mesh bar seines of appropriate lengths up to 30 ft. Invertebrates were identified in the field. Fish collected were preserved in 10% formalin and identified at the TPWD Inland Fisheries laboratory, Marshall, Texas. Photographs were taken at observation sites using a 35 mm SLR camera and color print film.

The Watershed was traversed by truck. Observation points were reached by truck, boat, and on foot. Care was taken not to enter private land without access clearance. Where a point was inaccessible, it was located by visual offset from the spot of closest public access and surveyed remotely. All points were located a minimum of 100 ft. from cover type margins. The geographic location of points was determined using a Rockwell ground positioning system (GPS) provided by USCOE.

Land and Cover Classification

A classification protocol was established to facilitate satellite imagery mapping of the entire Watershed, be compatible with other regional classifications, be resource management oriented, and have descriptors meaningful to a variety of users. The GAP classification did not meet reconnaissance needs. It had limited utility for users involved that were not trained in the disciplines of taxonomy and remote sensing. Some descriptors used were applicable to more than one cover type. The departure from conventional cover descriptions made it time consuming for ground trothing. Categories in the GAP system do not include some important Watershed land and cover types, e.g., open water, swamp, commercial pine monocultures. Consequently, a modified classification compatible with other classifications applicable to the Watershed (TPWD, 1980; McMahan, 1984; and Campo, 1986) was used for the reconnaissance (Table 1). The reconnaissance classification used groups certain sub-types for satellite imagery identification and statistical assessment, reflects current land use, and includes natural plant communities that require special attention (Table 2).

Mapping

Existing imagery maps either did not cover the entire Watershed, did not depict cover sub-types deemed to be important, or they lacked accuracy. A satellite imagery cover map was developed by USCOE from the reconnaissance ground trothing (Appendix C).

Table 1. Closest match of descriptors among five cover classifications applicable to the Big Cypress Bayou Watershed.

cypress [1] (1994)	McMahan et al. (1984)	Campo (1986)	TPWD (1980)	McKinney (1994)
Waterbodies	Unclassified	Water	Water	Unclassified
Marshes	___ do -----	Unclassified	Unclassified	Tall mesophytic grassland or graminoid bog. (5.A.4.d. 1)
Swamps	Bald cypress-water tupelo swamp (39)	Bald cypress swamp	Bald cypress swamp	----do ----- (5.A.4.d.l)
Shrub-dominated floodplain	Unclassified	Unclassified	Unclassified	Deciduous alluvial shrubland. (3.B.3.c.1,2)
Bottomland hardwood forest	Bottomland hardwood forest (31,36,38)	Mixed bottomland hardwood forest	Hardwood forest Flooded hardwood forest	Cold-deciduous alluvial forest. (1.B.3.c.1-7)
				Cold deciduous alluvial woodland. (2.B.3.d.1,2)
Grasslands - Hay field	Native or introduced grasses (45)	Grassland	Grasses	Tall grassland mainly sod grass. (5.A.4.a.3)
- Pasture				--- do -- (5.A.4.a.3)
Old field				Tall grassland, mainly sod grasses. (5.A.4.a.1,2)
				Medium tall grassland, mainly bunch grass. (5.B.4.b.3)
				Medium tall grassland with broad-leaved deciduous trees. (5.B.l.f.l)
Cropland	crops (44)		Crops	Cold-deciduous woodland without evergreen trees. (2.B.3.a.9)
				Agricultural land, active and fallow cropland. (7.A.2)

'Cypress Bayou Watershed 1994 Reconnaissance

Table 1. (continued)

Cypress (1994)	McMahan et al. (1984)	Campo (1986)	TPWD (1980)	McKinney (1994)
Shrub-dominated terraces and uplands	Young forest/grassland	Young pine forest/mixed hardwood brush	Easter" mixed hardwood brush	Evergreen broad-leaved sclerophyllous shrubland. (3.A.l.c.4)
-- Young pine plantations				Cold-deciduous semi-arid shrubland. (3.B.3.b.8)
Pine plantation	Young forest/grassland (41)	Young pine forest/mixed hardwood brush	Young pine forest	Tropical and sub-tropical lowland evergreen needle-leaved forest. (1.A.8.a.1)
Pine forest	Unclassified	(Type 2) Pine-hardwood forest	Pine forest	----- do ----- (if a pine monoculture). (1.A.8.a. I)
Pine-hardwood forest	Pine-hardwood forest (42.1,2,3)	Pine-hardwood forest	Pine-hardwood forest	Evergreen forest with rounded crowns. (1.A.9.b.1)
-- Unmanaged		Hardwood-pine forest	Hardwood-pine forest	Cold-deciduous broad-leaved forest with evergreen needle-leaved trees. (1.B.2.b.2)
-- Managed pine				Cold-deciduous woodland with evergreen needle-leaved trees. (2.B.2.b.1,3)
Unmanaged hardwood forests (Uplands)	Upland hardwoods (30,a,b,c; 35)	Upland hardwood forest	Hardwood forest	Temperate lowland and submontane broad-leaved cold-deciduous forest. (1.B.3.a.2-4)
				Evergreen needle-leaved woodland with conical crowns. (2.A.2.b.l)
				Cold deciduous broad-leaved woodland without evergreen trees. (2.B.3.a.4,5)
Urban/suburban/industrial	Unclassified	Unclassified	Urban/sparsely vegetated	Urban land. (7.A.1)
Bare ground	_____ do -----	----- do _____	Unclassified	Barren land. (6.A. 1 .a.)
Special attention plant communities	----- do _____	Sensitive and unique habitats	_____ do -----	Unclassified

Table 2. Land and cover types. Big Cypress Bayou Watershed ecological reconnaissance, June - October, 1994.

I. **Waterbodies and Tbeir Perimeters**
- A. Streams
- B. Reservoirs
- c. Lakes
- D. Ponds
- E. Swamps
- F. Marshes

II. Floodplains
- A. Bottomland hardwood forest
- B. Shrub-dominated floodplain

III. **Terraces and Uplands**
- A. Unmanaged pine-hardwood forests
- B. Unmanaged hardwood forests
- C. Managed pine forests
- D. Shrub-dominated terraces and uplands
  1. Natural assemblages
  2. Young pine plantations

IV. **Grasslands**
- A. Hayfields
- B. Pastures
- C. Old Fields

V. **Developed and Disturbed Land**
- A. Urban, suburban, and industrial sites
- B. Bare ground

Special Attention Natural Plant Communities Within Cover Types*
1. Bald cypress swamp
2. Bald cypress - water tupelo swamp
3. Water oak -willow oak bottomland
4. Shortleaf pine - oak upland
5. Bluejack oak - post oak

Unique Plant Communities
1. Bamboo - sweetgum
2. Smooth alder swamp

*Reference: Pers comm., M. M. Parker, TPWD

Information Management

Observations were recorded on field data forms (Appendix D) which were kept separate by land and cover types. Field information was then transferred to a Microsoft, Inc. Excel, v. 4.0, computer spreadsheet and a Borland Intl., Inc., Paradox for Windows data base. The Excel program enabled the grouping of numerical data by vegetation cover types, statistical analysis of data, development and presentation of an animal stocking model, and presentation of findings in tabular form. Paradox was used to store large amounts of data (e.g., common and scientific names of plants and animals) and match plant and animal species with their respective cover types.

To help assess their relative ecological roles, cover types were evaluated based on five measures: vegetation structural diversity (vertical [foliage height] and horizontal diversity [patchiness]), plant and animal species richness, and general habitat value for wildlife species characteristic of the particular types. Wildlife habitat value (WHV) was a subjective estimate made on each site observed. Values ranged from a high of five to a low of one (Appendix D). The mean of WHV site estimates within cover types was taken as the value for that type. The other four measures were statistically evaluated. An overall ecological quality rank (EQR) was assigned to the cover types based on the above five measures. A computer evaluation procedure was developed to prescribe indices of range forage production, optimum stocking (carrying capacity) for deer and cattle, and net revenues from hunting-rangeland grazing enterprises (Sheffield, et al., 1995).

FINDINGS AND DISCUSSION

Watershed Cover Types

Five land types, 18 cover types, 5 special attention plant communities, and 2 unique plant communities were encountered (Table 2) and are described below. Time constraints prevented a sufficient number of surveys on some cover types and sub-types for more than subjective assessments. Moreover, satellite imagery on hand did not distinguish certain types. In those cases, related types were grouped. Eight major cover types resulted (Table 3). Of the five ecological measures used to evaluate types, plant structural diversity and species richness statistically explained 86% of the variability (Appendix E). A graphic orientation of the eight types based on their diversity and richness suggested that wetlands (i.e., waterbodies and bottomland hardwood forests) and unmanaged pine-hardwood forests have greater plant diversity and species richness than the other cover types. Merchantable pine forests and pine plantations, cumulatively, are structurally diverse but comparatively poor species-wise.